

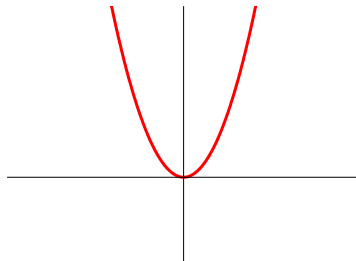
Edexcel AS Mathematics Graphs and transformations

Section 2: Transformations of graphs

Solutions to Exercise level 1

Do not use a graphical calculator or graphing software for this exercise.

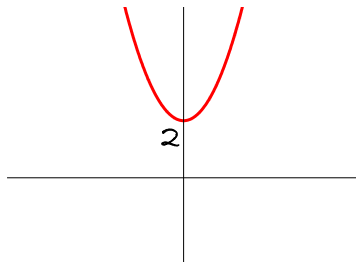
1. (i) $y = x^2$



Minimum point is $(0, 0)$.

(ii) $y = x^2 + 2$

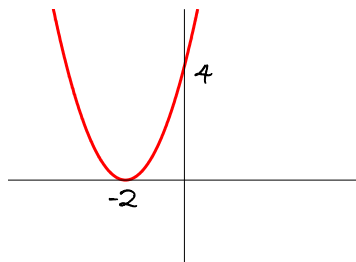
The graph of $y = x^2$ is translated vertically upwards by 2 units.



Minimum point is $(0, 2)$.

(iii) $y = (x + 2)^2$

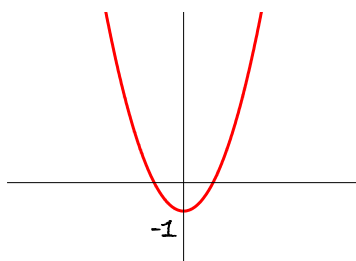
The graph of $y = x^2$ is translated horizontally to the left by 2 units.



Minimum point is $(-2, 0)$.

(iv) $y = x^2 - 1$

The graph of $y = x^2$ is translated vertically downwards by 1 unit.

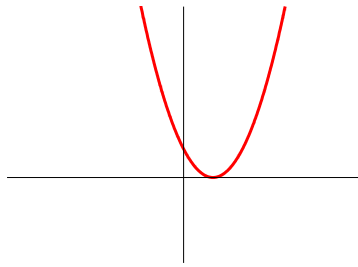


Minimum point is $(0, -1)$.

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(v) $y = (x-1)^2$

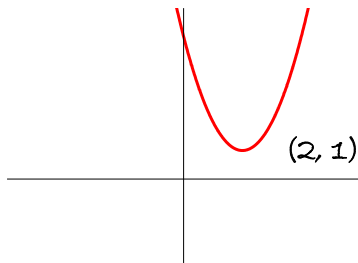
The graph of $y = x^2$ is translated horizontally to the right by 1 unit.



Minimum point is (1, 0).

(vi) $y = (x-2)^2 + 1$

The graph of $y = x^2$ is translated horizontally to the right by 2 units, and vertically upwards by 1 unit.

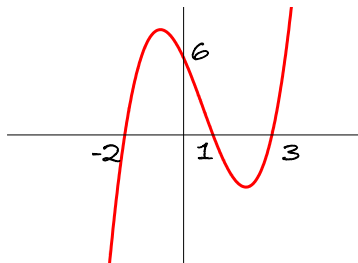


Minimum point is (2, 1).

2. (i) $y = (x-1)(x-3)(x+2)$

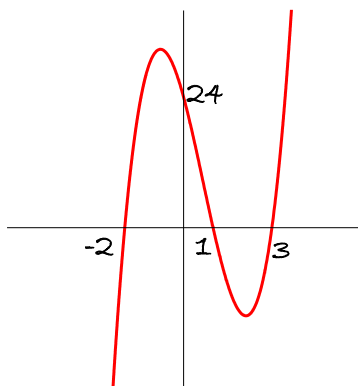
When $x = 0$, $y = -1 \times -3 \times 2 = 6$

When $y = 0$, $x = 1, 3$ or -2 .



(ii) $y = 4f(x)$

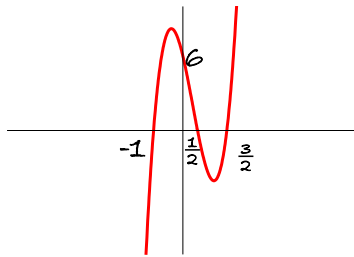
The graph of $y = f(x)$ is stretched vertically with scale factor 4.



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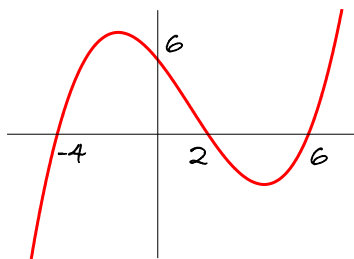
(iii) $y = f(2x)$

The graph of $y = f(x)$ is stretched horizontally with scale factor $\frac{1}{2}$.



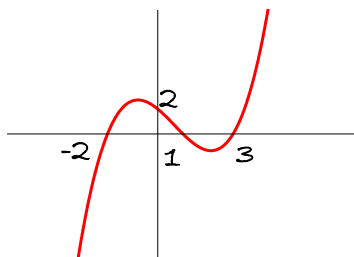
(iv) $y = f(\frac{1}{2}x)$

The graph of $y = f(x)$ is stretched horizontally with scale factor 2.



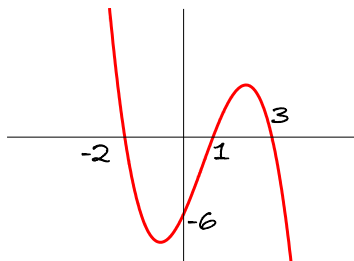
(v) $y = \frac{1}{3}f(x)$

The graph of $y = f(x)$ is stretched vertically with scale factor $\frac{1}{3}$.



(vi) $y = -f(x)$

Reflection in the x-axis



3. (i) $y = (x-2)^2$

$$y = x^2 - 4x + 4$$

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(ii) $y = x^2 - 2$

(iii) $y = \frac{1}{2}x^2$

(iv) $y = (\frac{1}{3}x)^2$

$$y = \frac{1}{9}x^2$$

(v) $y = (x-1)^2 + 2$

$$y = x^2 - 2x + 3$$

4. (i) Stretch, parallel to the y-axis, scale factor 3.

(ii) Translation by $\begin{pmatrix} -90^\circ \\ 0 \end{pmatrix}$

(iii) Stretch, parallel to the x-axis, scale factor 4.

(iv) Translation by $\begin{pmatrix} 0 \\ -1 \end{pmatrix}$

(v) Translation by $\begin{pmatrix} 180^\circ \\ 0 \end{pmatrix}$

(vi) Reflection in the y-axis

5. (i) Stretch, parallel to the y-axis, scale factor $\frac{1}{2}$

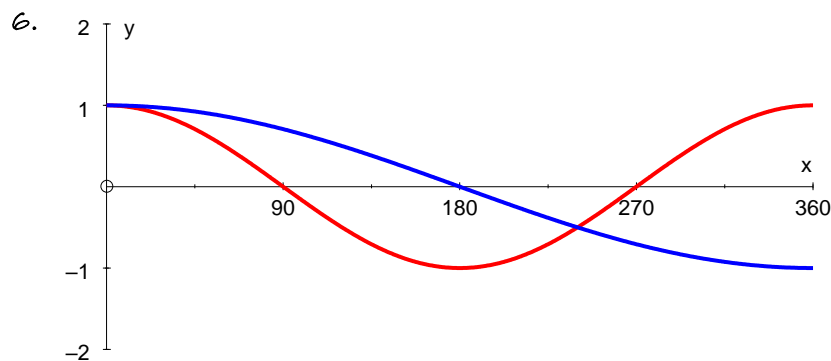
(ii) Translation by $\begin{pmatrix} 90^\circ \\ 0 \end{pmatrix}$

(iii) Stretch, parallel to the x-axis, scale factor $\frac{1}{3}$

(iv) Translation by $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$

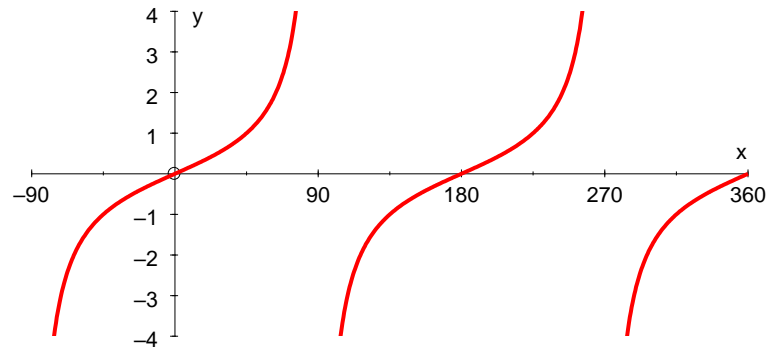
(v) Translation by $\begin{pmatrix} -30^\circ \\ 0 \end{pmatrix}$

(vi) Reflection in the x-axis

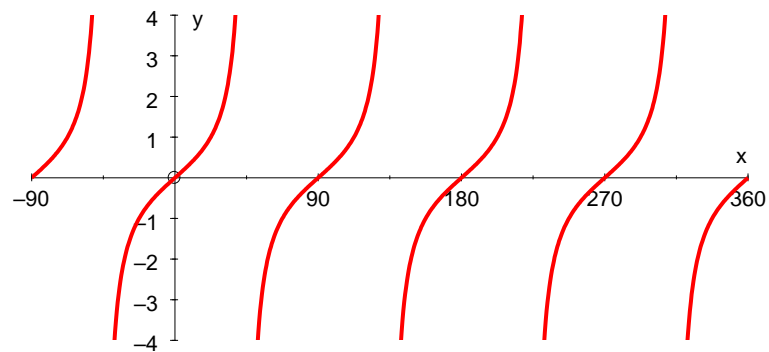


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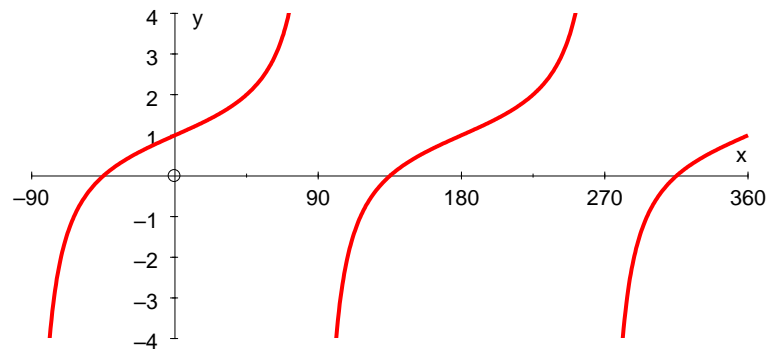
7. $y = \tan x$



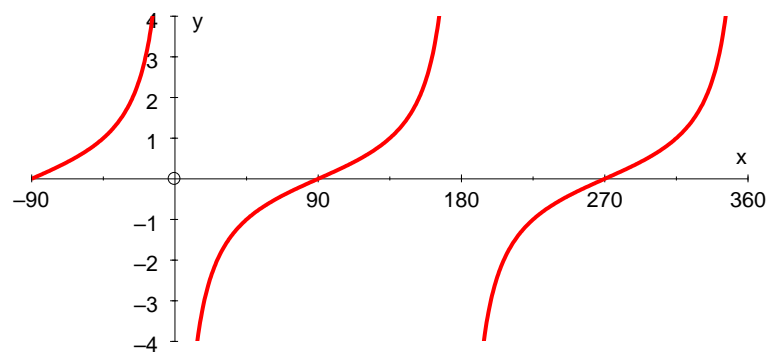
(i) $y = \tan 2x$



(ii) $y = \tan x + 1$



(iii) $y = \tan(x - 90^\circ)$



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